

REMARKS

Claims 9-13, stand rejected on prior art grounds. Claims 32-43 were withdrawn from consideration by the Examiner as corresponding to an un-elected species. Applicants respectfully traverse the rejections of claims 9-13 as well as the withdrawal of claims 32-43 based on the following discussion.

I. The Withdrawal from Consideration of Claims 32-43.

On September 10, 2002 a restriction requirement was issued in the parent application of the present invention (09/683498). Specifically, the Office Action found that claims 1-8 for "a bipolar transistor" were drawn to a device classified as an active solid-state device (class 257) and particularly, a "heterojunction device" (Subclass 183). The Office Action found that claims 9-13 for "a semiconductor for use in a bipolar transistor" were drawn to a device classified as an active solid-state device (class 257) and particularly, a "thin active physical layer..." (Subclass 9).

The 37 C.F.R. §1.111 Amendment filed on May 31, 2005, mistakenly added new claims 20-31 that were directed to the same bipolar transistor of claims 1-8. In response to an August 24, 2005, restriction requirement claims 20-31 were canceled and new claims 32-43 were submitted. New claims 32-43, while similar to claims 20-31, were specifically directed to the same species as original claim 9-13 "a semiconductor for use in a bipolar transistors." Independent claims 32 and 38 simply added the limiting features that the semiconductor layer of the invention also comprises "a single crystalline region" and "a polycrystalline region adjacent said single crystalline region." These claims further provided information disclosing the positioning of single crystalline region and the polycrystalline region in relation to the doped region and carbon atoms. While the independent claims 32 and 38 each mentioned benefits that the structure of the semiconductor of the invention provides when used by the bipolar transistor, the bipolar transistor itself was not claimed. Thus, the Applicants submit that claims 32-43 should have been considered the same species as claims 9-13 and should not have been withdrawn from consideration.

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Additionally, claims 32-43 are amended herein to remove references to any benefits provided by the semiconductor layer to a bipolar transistor, thereby, clarifying that these claims are drawn to the same species as claims 9-13.

In view of the foregoing, the Examiner is respectfully requested to reconsider and claims 32-43.

II. The Prior Art Rejections

Claims 9-13 stand rejected under 35 U.S.C. §102(b or e) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Lippert, et al. (WO 98/26457 or U.S. Patent No. 6,750,484), hereinafter referred to as Lippert. Claim 11 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Lippert, in view of Sakamoto (U.S. Patent No. 5,750,443) and Bisaro, et al. (U.S. Patent No. 5,141,894), hereinafter referred to as Bisaro. Applicants respectfully traverse these rejections based on the following discussion.

In response to the Applicants 37 C.F.R. §1.111 Amendment filed on May 31, 2005, the Office Action provides that the "semiconductor" in the preamble of claim 9 corresponds to the total semiconductor structure in Lippert, which is a "heterojunction bipolar transistor," and not just a semiconductor layer. This is contrary to the original restriction requirement which acknowledges that the species of claims 9-13 is drawn to an active physical layer (class 257/subclass 9+) and not to an entire heterojunction bipolar transistor (class 257/subclass 183+, see claims 1-8). However, to clarify this issue, claims 9-13 and claims 32-43 are amended herein to reflect that the semiconductor of the invention is a semiconductor layer for use in a bipolar transistor and, thus, not the entire bipolar transistor structure itself.

More specifically, the Applicants respectfully submit that the Lippert invention does not teach, suggest or make obvious the following features of the semiconductor layer of independent claim 9: (1) a "a doped region that comprises less than all of said semiconductor layer and comprises a dopant interacting with said carbon atoms;" and (2) "wherein said carbon atoms limit outdiffusion of said dopant within said semiconductor layer to physically limit a size of said doped region."

Additionally, the Applicants respectfully submit that the Lippert invention does not teach, suggest or make obvious the following features of the semiconductor layer of independent claims 32 and 38: (1) a single crystalline region; (2) a polycrystalline region adjacent said single crystalline region; (3) carbon atoms within said single crystalline region and said polycrystalline region; (4) a doped region in said single crystalline region adjacent said polycrystalline region, and (5) wherein said carbon atoms limit outdiffusion of said dopant such that a size of said doped region is physically limited within said semiconductor layer.

More particularly, Lippert describes a complete bipolar transistor structure with a base layer 34 grown by eptiaxy from a highly doped silicon substrate 31. Carbon is used in the entire base layer to prevent outdiffusion of the dopant (boron) from the base layer. This allows the overall size of the base layer to be scaled (see Lippert Col. 2, lines 45-50, see Figure 3) or allows the amount of dopant to be increased (abstract). Thus, the dopant in the base layer of Lippert is not limited to within a given region having a limited size, but rather extends throughout the base layer which limits broadening of the base region (see Col. 2, lines 53-57).

Contrarily, the claimed invention includes a semiconductor layer for use with a bipolar transistor and, specifically, a semiconductor layer with reduced resistance that is achieved not by doping an entire semiconductor layer, but rather by providing a doped region within the semiconductor layer and limiting the size of the doped region in relation to the entire semiconductor layer by incorporating carbon atoms into the semiconductor layer (see paragraphs [0035, 0039 and 0040]). The semiconductor layer of the invention can also comprise both a polycrystalline semiconductor region 6 (e.g., a conductive amorphous polysilicon germanium carbon film positioned above a shallow trench isolation structure 7) and a single crystal semiconductor region 5 (e.g., single crystal silicon germanium carbon film positioned above another semiconductor layer 15 (see paragraphs [0037] and [0070] and claims 32 and 38). The doped region 8 can be located within a central portion of the semiconductor layer between two contacts and, specifically, can be located within the single crystal semiconductor region 5 and adjacent

to the polysilicon semiconductor region 6 (see paragraph [0038] and Figure 12). The carbon in the semiconductor regions 5, 6 limits diffusion of the dopant outside the small doped region 8 and helps keep the boron in a tight physical distribution within semiconductor regions 5, 6 (see paragraphs [0042] and [0044]). Limiting the size of the doped region within the semiconductor regions 5, 6 provides improved resistance control (see paragraph [0047]) allowing for increased speed and breakdown voltages (which decrease electrostatic discharge (ESD)) (see paragraph [0034]), when the semiconductor layer is used in a bipolar transistor.

Therefore, amended independent claims 9, 32 and 38 are patentable over Lipper. Further, dependent claims 10-13, 33-37 and 39-43 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings, and no new matter is being added. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

II. Formal Matters and Conclusion


With respect to the rejections to the claims, the claims have been amended, above, to overcome these rejections. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections to the claims.

In view of the foregoing, Applicants submit that claims 9-13, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary. Please charge any deficiencies and credit any overpayments to Attorneys' Deposit Account Number 09-0457.

Respectfully submitted,

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